

AEDC

Arnold Engineering Development Center
Arnold Air Force Base, Tenn. 37389

An Air Force Materiel Command Test Facility

America's
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16-Foot Transonic Wind Tunnel

The 16-foot Transonic Wind Tunnel (16T) is part of the Propulsion Wind Tunnel (PWT) Facility at the U. S. Air Force's Arnold Engineering Development Center (AEDC), located at the Arnold Air Force Base in southern Middle Tennessee.

Built in the 1950s, 16T and the PWT complex is in the final stages of a modernization program to automate much of the facility and keep it state-of-the-art.

Virtually all high-performance flight systems used by the U. S. military today and many NASA space programs as well as many commercial aircraft have been tested in this high throughput tunnel. It is a variable-density, continuous-flow wind tunnel capable of being operated at Mach numbers from 0.06 to 1.60. The facility is recognized as an international mechanical engineering landmark because of its 30-ft diameter three-stage compressor drive system. The system drives up to four electric motors totaling 271,000-hp to power the tunnel. It operates stagnation pressures from 120 to 4,000 pounds per square foot absolute (psfa). The maximum stagnation pressure attainable in 16T is a function of Mach number.

AEDC originally designed this versatile tunnel for propulsion integration testing. It is capable of simulating flight conditions while operating turbine and rocket propulsion systems. A captive trajectory support (CTS) system to accommodate large-scale store separation testing was later added by AEDC. Stores are bombs, rockets or fuel tanks carried on combat aircraft.

AEDC integrates world-class test facilities with state-of-the art analysis techniques to provide test and evaluation customers with complete testing and analysis capability.

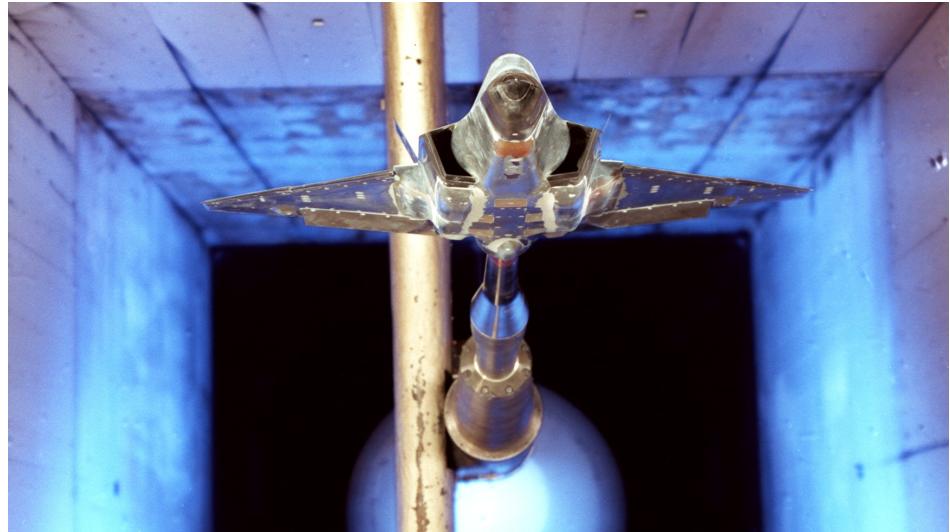


Photo no. 02-01006

The F-35 Joint Strike Fighter, one of several JSF variants being tested in 16T.

Computational experts can determine aerodynamic loads and flight simulations before the wind tunnel test using empirical, analytical, and/or viscous computational fluid dynamics methodologies. Data predictions are typically used to identify test matrix variables, variable ranges, instrumentation requirements, or support system interference.

Analysts familiar with the test data assess it in real-time to provide an inde-

pendent review of the test results. Following the test, a variety of performance assessments, flow visualizations, and mathematic modeling are used to expand the test database. The 16T data acquisition systems are located onboard the test cart. This feature greatly reduces tunnel installation time because the data systems used for model preparation go to the tunnel with the model and are used for testing.



Navy F/A-18 wind tunnel model in 16T. An 8-percent scale model of the aircraft was used to investigate vehicle performance with various store configurations.

Photo no. 95-053220

Test Capabilities

- Aerodynamic Performance
- Lateral and Longitudinal Static Stability
- Pressure Loads (Transducers and/or Pressure Sensors)
- Propulsion Plume Effects (Hot and Cold)
- Propulsion Plume Signature Measurement
- Rocket and Turbine Propulsion Systems
- Captive Trajectory Store Separation
- Dynamic Drop Store Trajectory
- Flutter and Aero-Elastic Effects
- Flow Field Surveys
- Inlet Engine Compatibility
- Inlet Performance
- Inlet Drag
- Full-Scale Flight Vehicle
- Cruise Missile Operability
- Ejection Seat
- Deceleration Devices

Excellent Flow Quality

- Uniform Flow Properties
- Low Free-Steam Turbulence
- Low Free-Stream Contamination
- Low Mach Number Uncertainty

Test Confidentiality

- Facility designed to meet the strictest security requirements
- Experienced with foreign countries and commercial interests

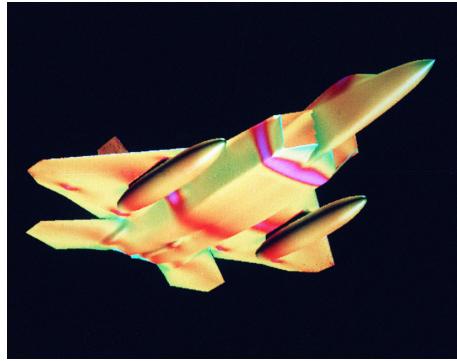


Photo no. 93-251616

Computational Fluid Dynamics
image of the F/A-22 Raptor. AEDC
possesses a broad range of
analysis capabilities to support
test and evaluation customers.



Photo no. 94-171004

A model of Boeing's 767 commercial jet undergoing testing in 16T. Historically a facility devoted to testing DoD systems, AEDC's 20-year alliance with Boeing symbolizes an emerging trend of government/industry partnerships.



Photo no. 99-0517-209

State-of-the-art 16T Control Room

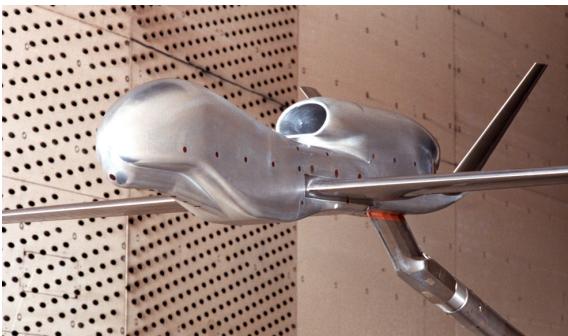


Photo no. 96-023403

"Global Hawk," Teledyne Ryan Aeronautical's unmanned reconnaissance aircraft in 16T. The test provided aerodynamic characteristics, control surface effectiveness and drag information.

Some of the dozen of different store models used during testing the F-15 Strike eagle dual-role fighter aircraft. More than 500 aircraft/store configurations have been investigated to ensure that the F-15E can safely deliver a wide array of weapons needed to accomplish its air-to-ground and air-to-air missions.



Photo no. 90-51905

AEDC Background

Arnold Engineering Development Center is the nation's largest complex of flight simulation test facilities. The center was dedicated in June 1951 by President Harry Truman and named after 5-star General of the Air Force Henry 'Hap' Arnold, visionary leader of the Army Air Forces in World War II and the only airman to hold 5-Star rank. Today, this \$7.5 billion complex has some 58 aerospace test facilities located at Arnold Air Force Base, Tenn., and the center's remote operating location Hypervelocity Tunnel 9 in White Oak, Md. The test facilities simulate flight from subsonic to hypersonic speeds at altitudes from sea level to space. Virtually every high performance flight system in use by the Department of Defense today and all NASA manned spacecraft have been tested in AEDC's facilities. Today the center is testing the next generation of aircraft and space systems. For more information on AEDC visit the center's Web site at www.arnold.af.mil



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